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Application of macro scale urban planning theory in the context of post destruction rebuild efforts: A case study of post Blitz Bombing London Green Space creation.

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Tiivistelmä – Referat – Abstract

This thesis looks at an example of how cities can be affected by large scale destruction and subsequent reconstruction, through the case study of post WW2 London bombing and rocket damage and rebuild. This is viewed with the idea that there was a promised effort by planners of the period to move to a more Utopian city layout for London as set forth in the ideals of Ebenezer Howard's Garden Cities of To-Morrow.

This thesis seeks to answer three questions: (1) What impact did the Blitz Bombings/V Strikes of WW2 have on London? (2) Which green space or public areas around today were created as a result of the bombings? (3) Did the urban planners apply E. Howard's Garden City Theory to the restructuring of land use as promised?

This has been done by the use of a comparative GIS exercise utilising pre and post War maps of six London boroughs forming the study area, and an aggregate of bomb and rocket incidents recorded from various sources, to determine which areas which has been previously urban in nature and then damaged were rebuilt as a Green or Open Space. Emphasis was placed on transformation of the old and new maps as well as categorisation of the various Green and Open Space types.

The findings of this thesis were that although the damage to urban areas was extensive during this period, the overall layout of London did not change significantly in terms of Green and Open spaces, and any changes that were made were opportunistic rather than a noted trend towards Howard's ideals. It also offers commentary on the process of utilising pre-GIS maps in a modern context and its shortcomings in terms of data accuracy.

Avainsanat – Nyckelord – Keywords
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2. Introduction

The aim of this thesis is to investigate the relationship between post large scale destruction events and subsequent rebuilding efforts and macro scale urban planning theory by using the reconstruction of post WW2 London as a case study, specifically focusing on the creation of new green spaces from previously constructed areas in aid of following Ebenezer Howard's Garden City of To-Morrow theory.

2.1 Overview

City planning and macro scale planning theory are often limited in their chances for applicability. In new suburban areas, city planners may sculpt the morphology of the emerging landscape almost at whim, bound only by topography and fiscal constrains. In more established, dense, urban areas, the chances for large scale changes are limited, there are often too many factors to consider that limit the scope of progress. Change, when it comes, is slow and in small steps.

However there are a few circumstances that allow for large sweeping changes to be made to inner urban landscapes and land uses, unfortunately almost all of these follow on the wings of tragedy. Earthquakes, fires, floods, landslides and in more recent decades, the devastation of war leave large swathes of urban land destroyed and ripe for rebuilding and replanning. Though invariably the circumstances that lead to such destruction and loss of life are tragic, there is a chance for urban planners to truly make some difference in the way the city is formed, rather than just rebuilding it to its old specifications.

This thesis seeks to answer how urban planners and macro scale planning theory interact with large scale rebuilding efforts post mega destruction events, and examine what the true drivers of rebuilding decisions and land use changes are. This is examined through a case study of London and its reconstruction efforts, specifically surrounding the creation of new green spaces following the Blitz bombing and later V rocket strikes during the Second World War.

The Blitz was a long series of continuous nightly bombing raids on Britain and its countryside that left thousands dead and many more homeless in destroyed urban areas, later followed by the indiscriminate rocket artillery strikes on England from the

Vergeltungswaffen (Vengeance Weapons or V1 and V2) that utterly devastated an already damaged city. These urban areas had once been the typical dark, dreary gray urban hells that inspired the works of Dickens and Blake, areas that had sprung up with little or no planning and with conditions less than optimal, the veritable home of the dark satanic mills and choking smog. Urban planners and propaganda workers alike saw the blasted and destroyed landscape of London as an opportunity to both rebuild and improve on the poor conditions that were present before and inspire a downtrodden people to fight for a brighter future. The utopian planning theory of Ebenezer Howard and his Garden City became planning gospel and the future of London was surely ordained to become a paradise combining the best elements of both country and town life. These rebuilding efforts continued throughout the war and during the recovery period of the 50's with the last of the destroyed homes and areas rebuilt during the late 1980's.

2.2 Research Questions

This thesis will focus on the following questions:

- What impact did the Blitz Bombings/V Strikes of WW2 have on London?
- Which green space or public areas around today were created as a result of the bombings?
- Did the urban planners apply E. Howard's Garden City Theory to the restructuring of land use as promised?

2.3 Methodology

The overall methodology of this thesis is one of observation and comparison of maps, namely the map of pre-War “London”, the bomb damage categorisation maps and data and post-War maps. This is done by conducting a comparative GIS project between two or more areas on the maps, in order to identify which areas have changed in land use to green/open spaces.

The first step of this comparative GIS project is to identify potential areas of study by looking at various factors. The primary civil unit of demarcation in London is the borough, of which there is a further split between inner and outer city boroughs. The reasoning for using these demarcations as guides for target study areas is that these are the most likely to

have their own maps created for them, and likewise have their own organs of governance or defence networks which would maintain data from the period. Prior to 1963 (London Government Act 1963), these areas were semi antonymous in practise and numbered 29 inner city boroughs, but were in actual fact controlled by larger county councils, which were consolidated based on the Royal Commission on Local Government in London Report of 1960, which suggested borough and council reformation. Since the main period of concern is the 1940's onwards, data will sometimes refer to the old designation and structure of the boroughs although these will be framed in the newer context in the modern maps in the comparative section. There is a risk that some areas may have rebuilding efforts that spill into other boroughs, either through the size of the property, nature of the land use or change in demarcation, but these should only be on the border regions and can be handled on an adhoc basis in the project.

The comparative GIS exercise is done by first identifying and classifying all the green and open spaces in the study area that have been effected by bombs and/or rocket strikes during the war. The classifications of green spaces will be made based on the green and open space definitions found in Chapter 1 and the Bomb Sight map (bombsight.org) and V1/2 strike maps will provide the geo-referenced aggregate locations of bomb and rocket drops during the Blitz and later half of the war.

The view of pre War London is provided by use of the Ordnance Survey Maps for London, specifically the 1950-1960 1:25000 series, TQ37, 38, 47 and 48. The Ordnance Survey Maps was a nationwide project undertaken a few times in the part by British mapping authorities in order to provide a comprehensive view of the entirety of Britain and its towns and countryside. These maps were bound by the technology of the time and painstakingly made by hand over decades. The 1950/60's series was actually started in 1936, well before the war started. This map was chosen as a primary source over the later bomb survey maps (which have still provided data) as it is printed in 5 colours and is incredibly detailed given the manner in which is was made, sometimes down to individual homes and gardens and larger trees are drawn in. These colours and details are focused on green and open spaces, which was part of the original purpose of the Ordnance Survey maps, and allow for easy identification of these features.

These maps are not however perfect and there are some issues in using them, chiefly that although the maps were started in 1936 and revised one or two times between then and the

60's when that particular series had was deemed finished, there is no distinction of what is a 30's, 50's or 60's feature (no Ordnance maps were revised during the 40's). Thus the where a feature is identified as reconstructed bomb damage, this must be verified against non-colour Bomb Survey maps used in on the Bomb Sight web-page.

Additionally there are several other smaller issues which must be taken into account when considering the accuracy of the comparison of “old” and “modern”, mostly revolving around the consistency of applying the legend of the map. In the example below, trees are used to represent a natural wooded area, which is easy to designate.

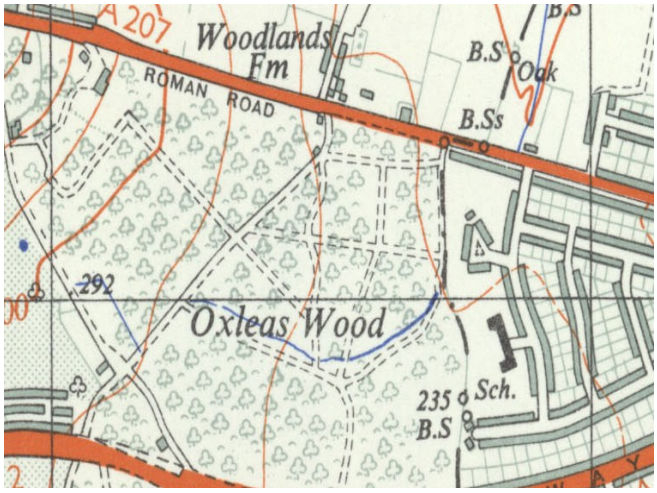


Image 1: Oxleas Wood (Ordnance Survey Map Sheet TQ47)

However this example shows two man made green spaces on either side of a road. One contains trees and shaded in grass areas, the other contains nothing, just the plot boundaries are drawn. In this situation, without a name written above the plot, it is just designated in

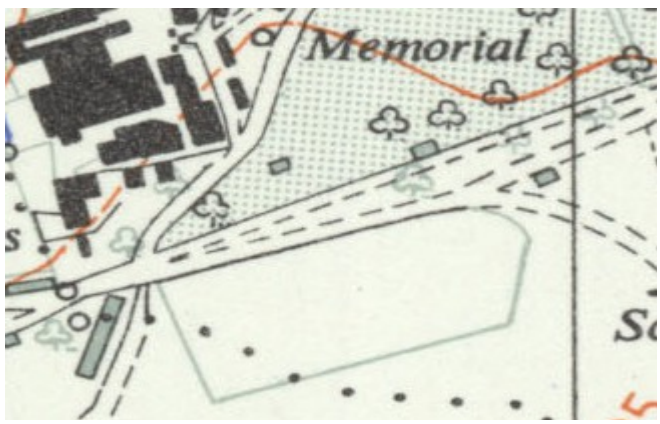


Image 2: Barrack Field, Ordnance Survey Map, Sheet TQ47

the most generic/appropriate option, namely Parks and Recreation.

Likewise, in the below example, there is a plot named nursery using the feature representation for orchard. As this plot is surrounded by houses (green polygon with small attached open plot), I have assumed such sites are community accessible rather than a natural space or maintained park.

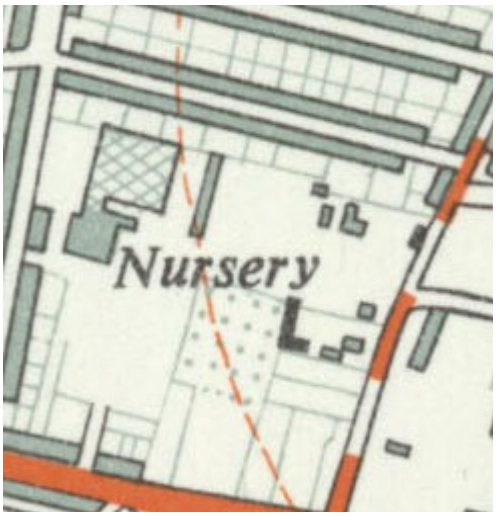


Image 3: Nursery, Ordnance Survey Map, Sheet TQ47

Additionally, some plots may indeed be open in nature but not open to public use, such as large manor houses and their grounds and private school grounds. These were included in the designation as open space because they are accessible to the public on some occasions and can be used as open/green space. This is not an issue on the modern maps where metadata indicates the accessibility of a feature.

Lastly these are the following feature types which were excluded from the designation:

- factory grounds and gardens
- natural water ways (streams and rivers as well as the River Thames)
- individual gardens attached to plots
- roads and highways
- railway lines and tunnels

Used in accordance with these maps are the bomb surveying records, which attempt to collate as much information as possible on the nature of the bomb that dropped, what it hit and what kind of damage it did. There were three main types of bomb dropped during the first nights of the Blitz, namely incendiary and explosive bombs and crude oil to help spread fire. These bombs were of smaller ordnance size, from 25kg to 50kg but dropped in their thousands (Bombsight.org). These bombs have been recorded collectively regardless of type and given a radius of 50m destruction/damage as an aggregate. This does not account for the spread of fire, smoke damage and chain detonations from unexploded bombs (Bombsight.org).

With the V1/2 rocket strikes, these are less accurate due to the extreme nature of the damage they inflicted and the fact that most structures had already been bombed in the Blitz period, particularly in East London where the damage was most wide spread and comprehensive. V2 rocket strikes were not often recorded at the time of the war because of the nature of the damage to the area and the frequency at which they were sent, this was simply too much to collect given the limited resources of the time and situation. Thus most V2 strike locations are from amateur and/or secondary sources, either people who were teens or children during the time recollecting where the bombs feel, or so rocket enthusiasts who are able to identify strike locations due to impact craters, proximity to found rocket parts and old paper clippings. These locations have been coallated in modern digital maps and at best the accuracy of most of them is approximate. Due to the large size of the explosion and damage this caused, this approximation does not impact on accuracy as they provide a large assumption or aggregate of damage which sufficient given the nature of the data, source and usage. For the purpose of this thesis, I have categorised both V1 and V2 as “Rockets”, and have used a buffer of 200m from point of impact to represent the damage they caused. This is based on data and reconstructions gathered from V2 rocket experimentation (Verbeek, 2005). This data shows that at a range of 180m from blast radius windows are shattered from the blast and is the extent of the damage radius, however these tests do not account for other damages that may incur from hitting civilian targets, such as the spread of fire, which is why a maximum assumed range of damage of 200m is used.

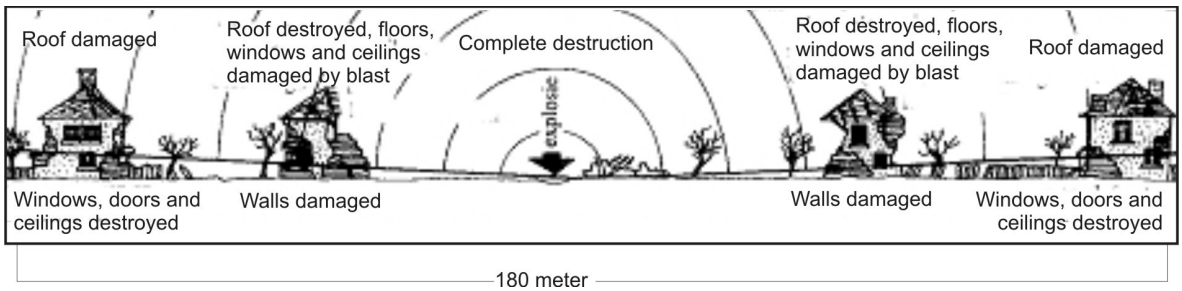


Image 4: Blast Radius and Damage of V2 Rockets, Verbeek, 2005.

Lastly, for the purpose of this thesis, it is assumed that where a bomb has fallen the damage is sufficient enough to warrant a choice to be made, either rebuild/repair the remaining structure or re-purpose the land for green use. Thus areas marked by bomb strikes are noted "damaged" although this includes both damage and outright destruction.

I will then conduct the comparative GIS exercise between the pre and post War versions of each map. In preparing for this research project, I discovered that no formal set of rules or methodological guideline exists in the field for comparing and old map to a new one, only scattered suggestions in various articles of what individual teams have used. From these research methods, I have deduced my own theoretical framework for a methodology for this purpose.

1. Determine the scale and representational system of both maps, if any for the old map. If the map is older than the modern referencing system, enough common points of identification must be determined, such as known long standing buildings and streets. The older the map, the less accurate it is likely to be, and this must be taken into account (Banaszek, Gajos, Karkozs, Rahmonov and Parusel, 2014)
2. As much as possible, maps must be compared with maps of the same kind, e.g. orthophoto with orthophoto. Where this is not possible, i.e. due to the map being older than orthophoto technology, extra care must be given to accuracy (Brigante and Radicioni, 2014).
3. The datum of both maps must be checked and adjusted according to the datum of the newer of the maps in the series, which is more likely to be accurate and updated with modern techniques (Brigante and Radicioni, 2014). Both the Ordnance Survey and modern maps for the region us the British National Grid and Datums with the Airy spheroid.

   Known spheroids/datums for UK are:

Spheroid/Datum	Year	Semi Major Axis	Semi Minor Axis
Airy	1830	6377563.396 m	6356256.91 m
International	1909/1924	6378388 m	6356911.94613 m
GRS80	1980	6378137 m	356752.31414 m

Chart 1: UK Spheroid/Datum

4. The scope of the area in question, i.e. a town or other civil demarcation, must be checked for consistency, i.e. borders may have changed or the method in which population or area are calculated might be different. These must be clearly marked as such on the maps (Mojica, Gregory and Martí-Henneberg, 2013)
5. Once both maps have been digitised and input into a GIS program, as many known and provable distinguishing points of reference between the maps must be demarcated.

The main feature I will be looking for will be an overlap in major changes in land use types to green or open within areas affected by bombing. This a very strong indicator that there has a choice has been made to follow Howard's Garden City ideal rather than rebuild the previous structures. A practical guideline for identifying Howard's goals for greener cities are the following distinguishing features, note that not all are applicable when discussing open and green spaces:

- light industry only
- heavy use of rail
- publically owned and managed
- small (in reference to the entirety of the urban/suburban space)
- circular
- heavy focus on green belts
- decentralised
- walking/biking primary mode of public transportation

An example of this might be pre-War map shows a street with many row houses in it, and

the bomb damage map shows that these houses were bombed and partially destroyed or damaged. This is compared with the post-War map, where there is now a park in place of the row houses in an area otherwise suitable for other land uses showing a choice was made to make this a green or open space.

These findings and observations will be presented in using various statistical methods to show the extent at which it can be said Howard's theory was adopted in each particular area.

3. Chapter 1: Key Concepts

3.1 Greenspaces and the benefits of "green living"

3.1.1. Definition of Open and Greenspaces

Open and Greenspaces have a purposefully vague and wide definition, in that they apply to anything which is not already classified as residential, agricultural, commercial or industrial land. This extremely broad categorisation covers everything from small parks and communal plots to true wilderness and untouched land. As such, for the purpose of this study, it is important differentiate the various types of greenspaces that will be used and which will be not. As this deals chiefly with inner urban green spaces, there is almost undoubtedly no wilderness areas and all areas will have, at some point or another in the history of London been interfered with by human activity, likewise the presence of more rural orientated green spaces might be reduced, such as equestrian grounds that are typically first encountered in suburban areas. Below is the adapted definition of the various open and greenspaces one can find in and around London and its surrounding areas according to Greenspace Information for Greater London (GIGL), an authority on greenspace and its usage in the area (**http://www.gigl.org.uk/our-data-holdings/open-spaces/open-space-categories/**):

- Parks and Gardens
  - Park refers to traditional public open spaces laid out formally for leisure and recreation. They usually include a mixture of lakes, ponds, lidos, woodland, flower beds, shrubs, ornamental trees, play spaces, toilets, cafés and car parks.
  - Formal garden refers to spaces with well defined boundaries that display high standards of horticulture with intricate and detailed landscaping.
- Natural and Semi-natural Urban Greenspaces
  - "Common" is a formal designation. They are publicly accessible open spaces with few if any facilities. They will typically be mainly rough open grassland and/or woodland, and are less formal than parks or parkland.
  - Country Parks are large areas set aside for informal countryside recreation near or within towns and cities.
  - Private woodland refers to woodland which is not accessible for recreational use, and not managed for nature conservation.

    - Public woodland refers to woodland which is accessible for recreational use, but not managed for nature conservation.
    - Nature reserve is a category reserved for an open space that is managed primarily for nature conservation.
- Green Corridors
    - River
    - Canal implies an artificial waterway which is navigable. Docks are also included in this category.
    - Railway cutting and railway embankment
    - Disused railway trackbed
    - Road island/verge
    - Walking/cycling route
- Outdoor Sports Facilities
    - Recreation ground is an area of mown grass used primarily for informal, unorganised ball games and similar activities (including dog walking).
    - Playing fields comprise playing pitches, usually for football, but also for rugby and hockey, and in summer, for cricket.
    - Golf Course
    - Other recreational refers to sites that are used exclusively or predominantly for other organised sports such as bowls or tennis
- Amenity
    - Amenity green space is an expanse of grass used for informal recreation. There will be few, if any, facilities.
    - Village green is a formal designation. It is usually an expanse of grass in the centre of old villages, often used in the summer for cricket.
    - Hospital includes the grounds of any clinic or health centre.
    - Educational refers to school or college ground and field study centres where school education is the primary function.
    - Landscaping around premises includes communal amenity space around housing estates and community centres, and also landscaping around industrial premises.
    - Reservoir includes covered reservoirs unless these form part of a park.
- Children and Teenagers

    - Play space is a site set aside mainly for children.
    - Adventure playground is a defined play area for children in a supervised environment.
    - Youth area is a defined area for teenagers including skateboard parks, outdoor basketball hoops and other informal areas.
- Allotments, Community Gardens and City Farms
    - Allotments
    - Community Garden is an area that is generally managed and maintained by the local population as a garden and/or for food growing. They are normally restricted in their access.
    - City farm includes areas that are generally managed and maintained as a small farm by the local population, containing livestock and planting. They are normally restricted in their access.
- Cemeteries and Churchyards
    - Cemetery/churchyard includes burial grounds, graveyards, crematorium grounds and memorial gardens, and gardens or grounds of non-Christian places of worship.
- Other Urban Fringe
    - Equestrian centre includes any land used for intensive horse keeping and riding.
    - Agriculture includes arable and grazing land, including horse grazing and market gardening.
    - Nursery/horticulture
- Civic Spaces
    - City market square includes tarmac areas or paved open spaces, which may or may not include planting. They do not necessarily have seats and may just be a plaza area. They often provide a setting for civic buildings and opportunities for open air markets and civic events.
    - Other hard surfaced areas include other areas designated for pedestrians. The category does not include pedestrianised streets and car parks.
- Other
    - Sewage/water works
    - Disused quarry/gravel pit. This may be water-filled, but is not necessarily so.
    - Vacant land is land with no formal use.
    - Land reclamation is land recently decontaminated or reclaimed from disuse,

which has not yet been redeveloped.

- Others could be anything that does not fit any of the above categories, such as airfields.

Accordingly, for the purpose of this thesis, most of these categories are viable to be included as part of a Garden City themed plan and designation, except for civic spaces which are predominately open rather than green and not suitable. Additionally not all the categories need to be used on such a specific level and can be consolidated into the following main or broad designations:

Broad Designation	Categories Included
• Parks and Recreation (PR)	• Parks and Gardens • Outdoor Sports Facilities • Amenity • Children and Teenagers • Cemeteries and Churchyards
• Natural Greenspace (NG)	• Natural and Semi-natural Urban Greenspaces • Green Corridors
• Community Space (CS)	• Allotments, Community Gardens and City Farms • Other Urban Fringe

Chart 2: GIGL Green and Open Space Categorisation

3.1.2 Benefits of green living:

Ever since the spread of industrialisation in the 18th and 19th century and the accompanying grime and poor urban conditions it brings with it, those in favour of good health and environments have campaigned for the importance of greenspace and greenspace culture to be promoted (Hickman, 2013). At first these groups consisted of well meaning upper class individuals and doctors convinced that green spaces, however small, were the veritable lungs of the city and helped clear out smog and pollution and promoted better health for all (Jordan, 1994). Many of these greenspaces housed drinking fountains that provided clean and pure drinking water to the public free of charge, especially important in a period when

cholera was widespread and rampant. These fountains, as well as general literature on greenspace and healthiness were part of a ”Prevention is better than a cure” campaign that these well meaning societies ran (Hickman, 2013). This intial private and domestic policy to public health through the use of greenspaces was unprecidented in the period, and through constant promotion of their ideas, it was broaded accepted by society and government too, through the National Health Society (Tomes, 1990). The culmination of this was the grand planning scheme of Ebenezer Howard, Garden Cities of To-Morrow, combining the best elements of town and country living for a greener, healthier and happier society.

Although the Victorian proponents of greenliving were sophisticated in their thinking for the time, especially Howard who seems to have had a peek at the future and is accutely aware of environmental issues that later generations might face, they were limited by the means of their time, especially in medical and scientific thinking and machinery. Subsequent studies that have been done in the 20th and 21st centuries have saught to provide a more quantitative approach to proving that green spaces are more than just ”good for one's health” but have actual lasting and tangible benefits.

According to Lee and Maheswaran (Lee, 2010) most studies regarding the tangible health benefits in recent times have difficulty in proving casuation between improved health and acess to greenspace. The factors surrounding ones health, both mental and physical, are not well understood at the best of times, and many of the studies supporting the use of greenspace as improvements to health rely on qualitative data derived findings. However many other studies have focused on these qualitative fields as important rather than difficult to prove, and a resounding majority of of research done into the health benefits of greenspace use is positive. Some of the benefits are:

- access to space in which to excercise for free (important to low income families and people seeking low impact excersize that gyms do not offer)
- improved access to social space for gatherings/functions/cultural practises
- improved access to small scale socio-economic activity (i.e. Selling homemade goods in parks)
- improved urban environment and creation of specialised urban habitats
- rehabilitation of threatened species from human encroachment

Access to greenspace is not the only determiner of use and benefits however, quality of the

greenspace may also have a great impact on whether it is used or not. A well maintained park with many facilities will see more use than an overgrown wild patch or vacant plot (Lee, 2010). Age, gender, class and culture also have an impact on the type of interaction with greenspaces, for example elderly people (especially women) are more likely to use communal gardening facilities than younger man, and vice versa in the case of open air football fields (Lee, 2010), similarly a gardening rich culture such as secular British culture might place more emphasis on the use of communal gardens than another culture which does not value this as highly, so the precense and impact of these kind of green spaces is also affected by those with access to them.

Overall it is my belief that although expensive in terms of maintanence and construction, the creation and use of greenspace is important, regardless of the difficulty in proving real evidence for tangible quantitative improvements to both mental and physical health by their use. In this situation, it is the lesser evil to promote greenspace use and creation disregarding this as possible or placebo benefits are better than the alternative, which is to give up greenspaces for more urban constructions and sprawl. This has become increasingly important in the wake of more and more research around human environmental impacts, and as green spaces are deemed to be a prevention rather than a cure for people, so to are they thus for the environment as a whole.

3.2 Garden Cities of To-morrow

Garden Cities of To-morrow is Ebenezer Howard's utopian ideal for the future of British urban living, and although he himself had no official training or academic background in urban planning, his thoughts inspired a generation to follow the ideal of combining the

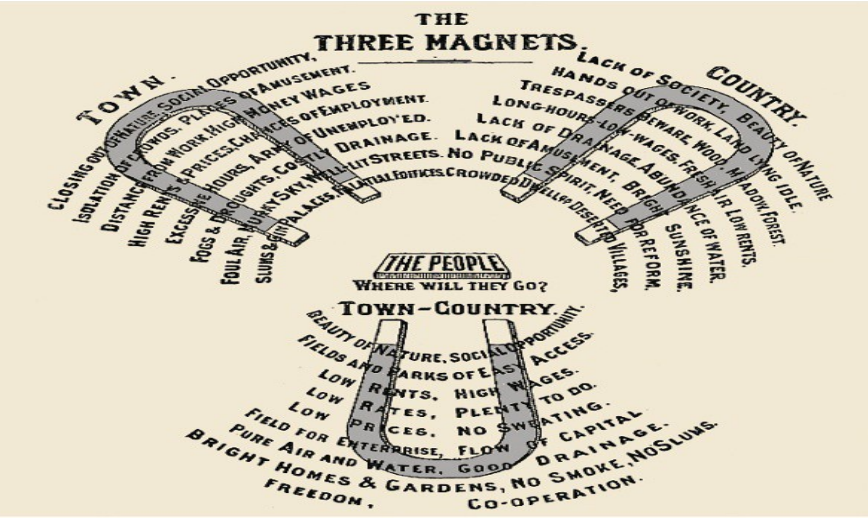


Image 5: The Three Magnets of Town, Country and Town-Country, Garden Cities of To-Morrow, E. Howard, 1898.

tradtional idyllic British countryside and country living with the trappings of modern cities. Howard's writings are styled in a very patriotic manner, he was writing at the turn of the 20th century in a period where Empire, King and Country were paramount to the British ideal, and as such his writings would well suit the atmosphere of the Blitz, during which they became popular again. Howard's main concern is that the quintisential ”Englishness”, associated with good wholesome country living and agrarian lifestyles, had been eroded by a century and a half of rampant industrialisation. Modern cities were swollen well beyond their medieval capabilities, shanty towns and ghettos were ever present and the new capitalist owned style of factory presented far better wages for young workers than the agrarian sector could ever offer in addition to more interesting amenities associated with big city life. Howard describes the phenomenon of rural-urban migration as a series of three magnets, the ones in the town being bigger and stronger than those in the outlying areas, and the worker a needle, inexoribly drawn to the strongest magnet.

Howard's third magnet is called Town-Country, a utopian state of existance combining the best characteristics of the lesser two magnets without their drawbacks.

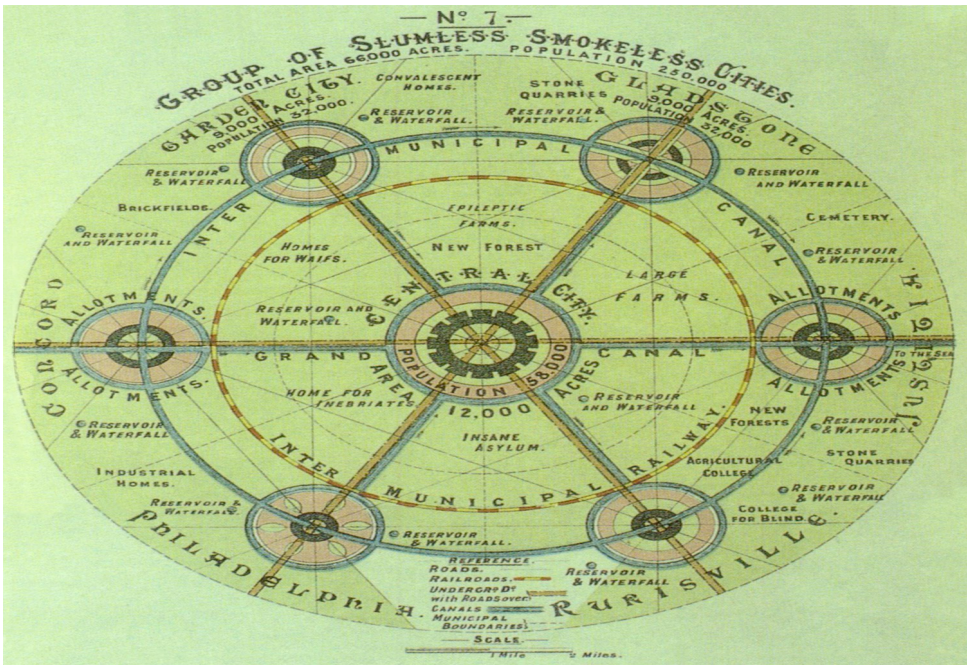
While suburban spaces might satisfy the characteristics Howard was looking for in his garden city, he imagined rather a complete reimagining of the entire city from top to bottom as well as the forms of production and means of ownership within the city and protection and distribution of land. Thus while his ideas for planning have been used widely by urban planners, his intial ideal was a far more comprehensive form of social engineering.

Howard called for the dismantling of large style cities, or at least heavily criticised them without giving any real practical solutions on how to tackle a place such as London. Instead he came up with the perfect small city that would be planned and created new in this manner. The cities would be limited to rougly 100 000 citizens, any more than this would warrant the creation of a new Garden City nearby the first seperated by a green belt.

This perfect city would be circular in nature in order to make dispersed amenities close in any location and making walking as the sole means of inner city transportation a possiblilty. The very core of the city would be a covered glass promonade like the Crystal Palace to encourage walking in any weather. Radiating outward from this would be a mix of commercial and residential zones, each seperated by a green belt and joined with walkways.

The last ring of the circular city is reserved for light industrial activity with a heavy focus on the use of rail as a means of inter city transportation and agricultural production. Howard suggests that any space not utilised be filled up with communal gardens and green belts, the produce created in these to be sold in the shops of the Garden City itself. To further this end, there would be strict planning on the kind of agriculture that would be permitted in the Garden City so that each would be, as much as possible, independant from

Image 6: Garden City Design, Garden Cities of To-Morrow, E. Howard, 1898.



the next.

Howard also had many ideas about the ownership of land, particularly in the fixing of rent prices for the alloments offered to residents. For example, each person owning a plot of land would be required to keep the rent at a commitee agreed level, and this would not be enforceable by law but rather an honour system, thereby circumventing the trend for newly renovated sururban homes to gather significantly higher rents (and profits) than high density low cost housing, which the allotments would replace. In doing this, Garden City would be open to all, rich and poor, worker and owner both to experience this best form of Town-Country life. These are some of his most utopian ideas and have subsequently not been used by planners trying to adhere to his ideals. Instead, the main focus of planners has been on his emphasis on green spaces and the seperation of industrial from residential life, and the efforts to downscale on fossil fuel means of transportation in favour of biking and walking.

Howard's ideas had other failings beyond the more unrealistic requirements of the

residents. All of his diagrams and examples were based on newly created cities that supposedly existed in flat unoccupied countries. He did not touch on how to incorporate existing structures and natural features into his ideas, such as the presence of water ways or immovable rock features that might be in the middle of the circular shape. Likewise, he never discussed the a Garden City that might have one hemisphere facing the sea, again disrupting his rounded shape and unaccounting for the need for shipping terminals and facilicties. Lastly, as mentioned before, he did not account for the existing large cities in England, such as London and Manchester and how Garden City would alliviate their problems of overcrowding and pollution, he merely offered an alternative rather than a solution, merely stating that by fully implementing the Garden City throughout England would reserve urban rurual migration and cause migrants to rather go for the Garden Cities themselves, thus alliviating some pressure on the larger existing cities.

Howard's ideas were eventually realised in a self funded experiment on a plot of land called Letchworth in the English countryside. He and his other investors bought out the land and started to develop it in the style he suggested. Letchworth today can still be thought of as a Garden City, but sadly it is one of a few. Howard's ideas were not ideal for those wanting to turn a good profit in the new property market and the Letchworth Garden City itself was barely profitable and needed many subsequent investment injections to keep the core of Howard's ideals alive. Eventually this project failed too, but Howard had a lasting effect on the way in which space is seen and utliised in Western Countries.

3.3 Wartime London

3.3.1 The Battle of Britain

The Second World War increased from the first in both scale and impact on society in never before seen ways. Where in previous times, war had been restricted to soldiers and battlefields, the invention of the aircraft and its subsequent enslavement to warfare changed the nature of the battlefield forever. During the Spanish Civil War, the Luftwaffe was called forth to practise their new form of warfare called Blitzkrieg, or Lightning Warfare, a doctrine focused on rapid movement of troops and armour and a comprehensive crippling of the opponents war economy before a response could be made. This was a devastatingly brutal solution that prevented armies from being bogged down in the trench warfare so definitive of the first world war. As cunning as this doctrine was, it was also brutal in its application, as the early bombers used to knock out enemy factories were not accurate in the slightest.

The larger bomber aircraft of the 1930's and 40's were lumbering behemoths that carried hundreds of kilograms of high explosive and incindiary bombs that were dropped from great heights above the targets. Bombing targets were photographed by spy planes or from ground intel and relayed to bombing command. Using maps and average flight times based on the speed of the craft, bombers were told when to drop their bombs and not where, bombardiers could confirm their targets visually, but since most bombing raids were conducted at night to aid in bomber defense, it became a case of carpet or saturation bombing rather than pinpoint accurate missiles that we are used to in the 21st century. As such, Hitler and his use of such techniques during the Spanish Civil War were heavily condemned.

During the first half of WW2, the British Expeditionary Force (BEF) landed in France to aid their beleugered allies, but being a much smaller force and organised mostly for colonial action, it was easily put down by the better equiped and armed mechanised Werhmacht. In May/June of1940 the British forces found themselves defending the Norman town of Dunkirk, now one of the most famous battle sites of the entire war. Faced with annihilation, the BEF dug in and prepared to defend the town to the bitter end while the German forces under Field Marshall von Rundstedt took time to consolidate their forces before assaulting the town. This move, now known at the Halt Order, was one the the most controversial and pivotal decisions made in the war. As the BEF and their allies were dug in, they had enough time for a flotilla of civilian ships from the British Isles and elsewhere to ferry large amounts of troops and materiel over the channel back to Britain, all at the time when Hitler was operating under the assumption of an impending British surrender. The move, often portrayed as a merciful allowance by a respectful Field Marshall meant that Britain had enough strength to partake and later win the upcoming Battle of Britain.

The Battle of Britain is a term used to refer to the air combat that dominated the skies above the British Isles during the mid period of WW2. Hitler, furious that the BEF had been allowed to escape, decided to bring forward his plans for Operation Sealion, the fullscale amphibious invasion of Britain. Britain has been notoriously hard to invade by sea for almost 1000 years, the last sucessful attempt being at the Battle of Hastings in 1066. As such, with modern developments in aircraft and avaiation, any ship attempting to make the channel crossing would find themselves at the mercy of coordinated defensive strikes from British shore defenses, Navy and Royal Airforce (RAF).

Hitler and Goering (Luftwaffer commandr in chief) decided that they could use the

superior numbers of the Luftwaffe to utterly crush British air defense without risk to their ground troops and make the sea invasion that much easier, ensuring the total domination of the Western Allies in the war. However the RAF would not be so easily defeated. Despite being outnumbered and up against some of the best fighter aircraft of the period, the plucky RAF managed to hold up the Luftwaffe time and time again. They were able to do this because of their newest secret invention, RADAR. Radars are now common place but during WW2 they were a new invention. Radar spotting towers and well trained older men and women identified flights and formations of German aircraft approaching the British Isles all along the coast, and radioed in the details. The RAF were able to response appropriately each time to the various threats and confounded German attempts at knocking out their air superiority. Additionally, British civil society went into total war mode, and Britian churned out Spitfires and other fighter planes faster than the Germans could shoot them down.

Hitler was once again furious that his efforts were being delayed and decided that if he could not destroy the RAF, he would destroy its support structures and break the back of the British. He was ultimately reluctant to do this as from the beginning he saw the British as natural Teutonic allies to the superior German race he envisioned. On Septmeber 7th 1940, the Luftwaffe began the series of bombing raids on civilian targets that would be known as The Blitz (short for Blitzkrieg)

3.3.2 The Blitz

As Madrid had been bombed during the Spanish Civil War, so too was London bombed during the Blitz. Although other cities were bombed during this period, London was the primary target and suffered the highest amount of bombings, suffering an intial period of 57 consequetive days of continuous nightly bombings, with the loss of 100 000 houses and 40 000 casualties at the beginning of the Blitz (Mackay, 2002).

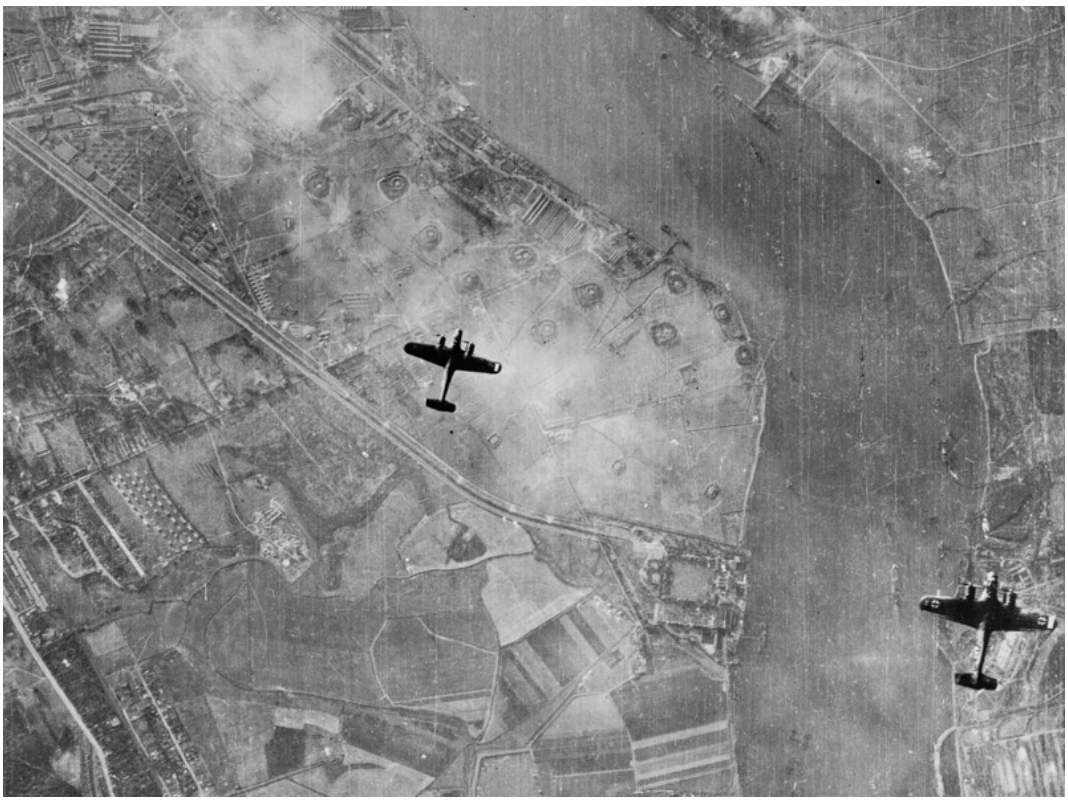


Image 7: German Bombers over Britain,C 5424, Air Ministry Second World War Official Collection

The intial response to the Blitz was rapid. Children had already been evacuated to the countryside and more northern cities beyond the range of German bombers, but civil defences needed to be improved. Many sections of the London underground were turned temporary bomb shelters. Other bomb shelters were spaced out over the city to provide the maximum coverage possible, those houses outside of this protection were offered Atkin's tables, a massivily heavy solid steel dining table that a small family could take shelter behind. Several anti aircraft emplacements were constructed and a city wide blackout was enforced, no lights on afterdark, only candles were allowed and windows needed to be blackened to prevent any light, even the smallest flame could give away important positions. In response, the German bombers became less and less concerned with charade of trying accuratly bomb military targets and bomb drops became indiscriminate (Gardiner, 2010)

The result of this was widespread destruction and death on a never before seen level. Britain, already bowed and humbled from their failure to defend their ally France, and now facing a very real war at home, was on the verge of a morale collapse. (Gardiner, 2010)

To improve the morale of suffering Britons, the War Office started a heavy campaign of

propaganda posters, including the now world famous ”Keep calm and carry on” (Mackay, 2010). These posters and the stories of those who lived through those times have created what is known as the Blitz Spirit, a near mythical ideal despite the bombings and hard ship, British people carried on through it all with a stiff upper lip and didn't complain and just did their part to contribute to the war effort. Many historians are now questioning the accuracy of this idea on the basis that modern people may be looking at those times through rose coloured glasses (Gardiner, 2010).

Image 8: "Keep Calm and Carry On", www.keepcalm.com

3.3.3 Rise of Social Town planning

Part of the Blitz propaganda campaign was the idea that Britain would be rebuilt, but not as it was before, better and stronger than it had been. The dark and dreary smoggy London of old was to be replaced with modern housing designed by the top Swedish architechts and every Briton would rightly have their own garden, which was of course as the propaganda stated, essentially to the foundation of the culture. Also, the people themselves became involved in the planning process, it was commonplace for discussions to be had around what should go where and when and why, discussions held in private without government input, all in aid of distracting themselves from the ongoing destruction. This was in addition to the previous privately funded initiatives by the groups such as the National Health Society, promoting good health for all through greener planning and access to

cleaner water and facilities (Hickman, C, 2013). The groups and the War Office adopted Howard's Garden Cities of To-morrow as the ideal for the better rebuilt Britain, and glossed over the shortcomings and difficulties such a project would face.

3.3.4 Vengeance Weapons

As the tides of the War shifted against the Germans and their bomber bases were pushed back and it was not economically viable to keep up the constant barrage on Britain, so to did the bombings stop. During the mid War period (1942 to 1944) there was relative calm above the night skies of London and the Allies bombed German assets in much the same manner. However in June 1944 Germany unleashed its new secret weapon on London. Code named Vergeltungswaffen (Vengeance Weapon or V for short), because of their ability to strike back at the invading allies, the V1 flying bomb was a pilotless self guided bomb or missile that could deliver a comparable amount of explosives with similar accuracy to the big manned bombers, with little to no threat to German lives. These weapons were launched from airfields in Northern France and used basic automated guidence systems to lead the craft in the general direction of the target, again without concern for the potential civilian casualties. Reports from the war estimate that the V1's as effective if not more so than bombers at causing damage because of the high cost of maintaining any kind of defensive network to counter them.

Image 9: Fieseler Fi 103 V-1 Vergeltungswaffe 1 or "Flying bomb" launch preparation, www.wermachthistory.com.

The V1 was soon replaced by the V2, which was one of the first rocket delivered warheads in history. Designed by the enigmatic German engineer Werner von Braun (who would later use the same technology to put people into space and onto the moon) the V2 could be launched from far further away than the V1 and delivered a much larger warhead layload. Mass production of the V2 saw more than 5000 units available for launch between August 1944 and February 1945. Though the payloads were bigger and the rockets more accurate,

there were several problems with them that diminished the effectiveness, such as the tendency to explode mid flight or on the launch pad. As Germany was unable to confirm the rocket landing sites themselves they relied on intel provided by their own spies. British counter espoinage efforts also saw German forces fed with false information regarding the landing sites of the V2s and the Germans ended up adjusting to hit lesser populated areas to the 20km West of Greater London. The V2 rocket strikes caused the most casualties in the shortest amount of time, and have had the most lasting effect on the British countryside. There are many amatuer V2 enthusiasts who have tried to collect data on all the stike locations (there were too many and too quickly to count as they had before), these can often been found by the impact craters and sometimes what seems like a natural pond is infact the filled in crater for a V2 rocket. Occasisonally parts of the rockets are still found 70 years later!

Image 10: V-2 Rocket Aggregat 4 (A-4) Vergeltungswaffe 2,www.wermachthistory.com

3.4 Study Area: Six Eastern London Boroughs

3.4.1. Overview

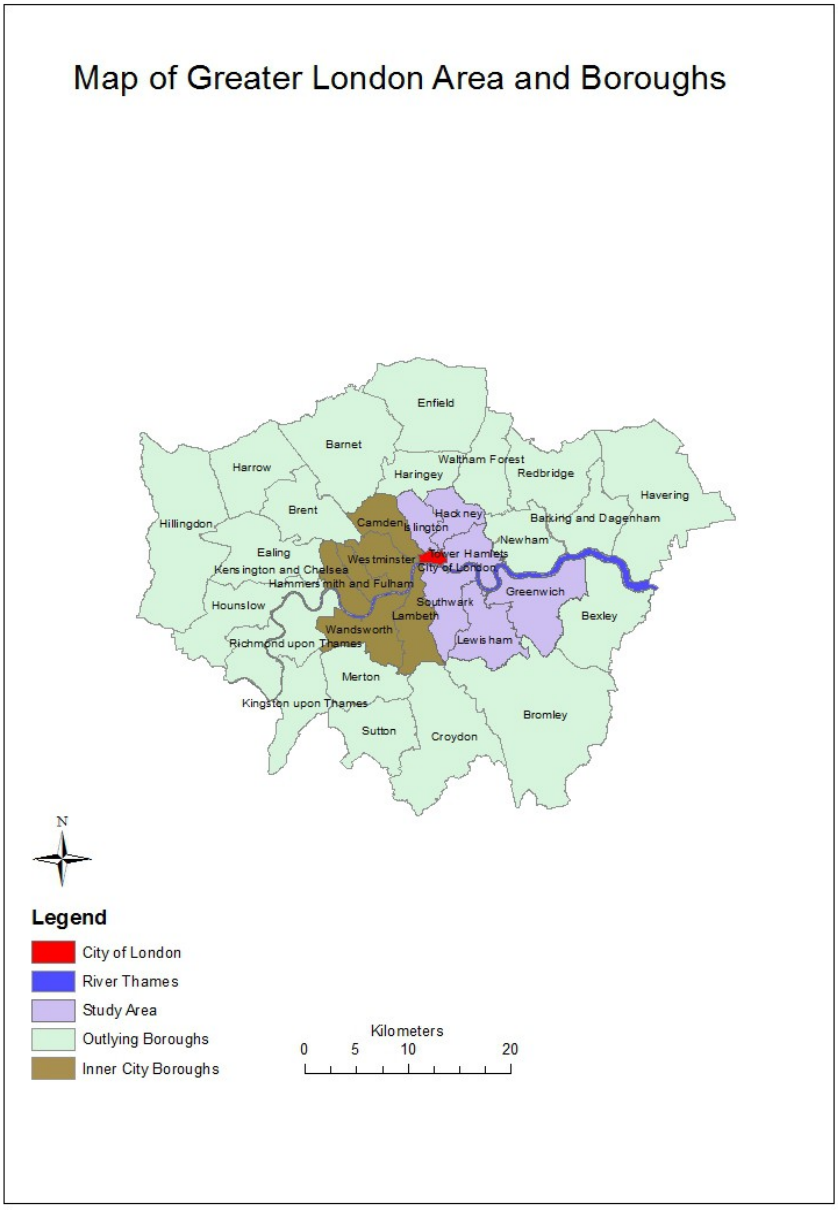
The study area for this thesis comprises of six boroughs (UK unit of demarkation for political and geographic boundaries in urban settings) that lie to the east of the actual city of London propper, which is itself the smallest borough of the entire area and the central feature of the metropolitan area. The chosen areas are bisected by the Thames River which runs West to East towards the English Channel right through the middle of the city. Southwark, Lewishham and Greenwich are all contiguous boroughs to the South of the Thames while Tower Hamlets, Islington and Hackney mirror them to the North of the river.

These areas were chosen for several reasons, first and foremost of these being the intensity of the bombing and rocket strikes in these locations. This was in part due to practicality, once the bombers were sighted by Civil Defenses, they would want to drop their load as quickly as possible before ascending to higher altitudes and away from anti air fire. In the case of V weapons, the eastern half of London was closer to the launch platforms in Normandy and the Netherlands and was just that much easier a target than the areas further West. Additionally, the populus of these boroughs were mostly comprised of working and middle class families, the very people the Luftwaffe sought to cripple in these strikes. That being said, the bomb strikes are pretty comprehensive throughout London and any areas investigated were equally devastated by bombings.

Chart 3: London Inner City Borough Explanation

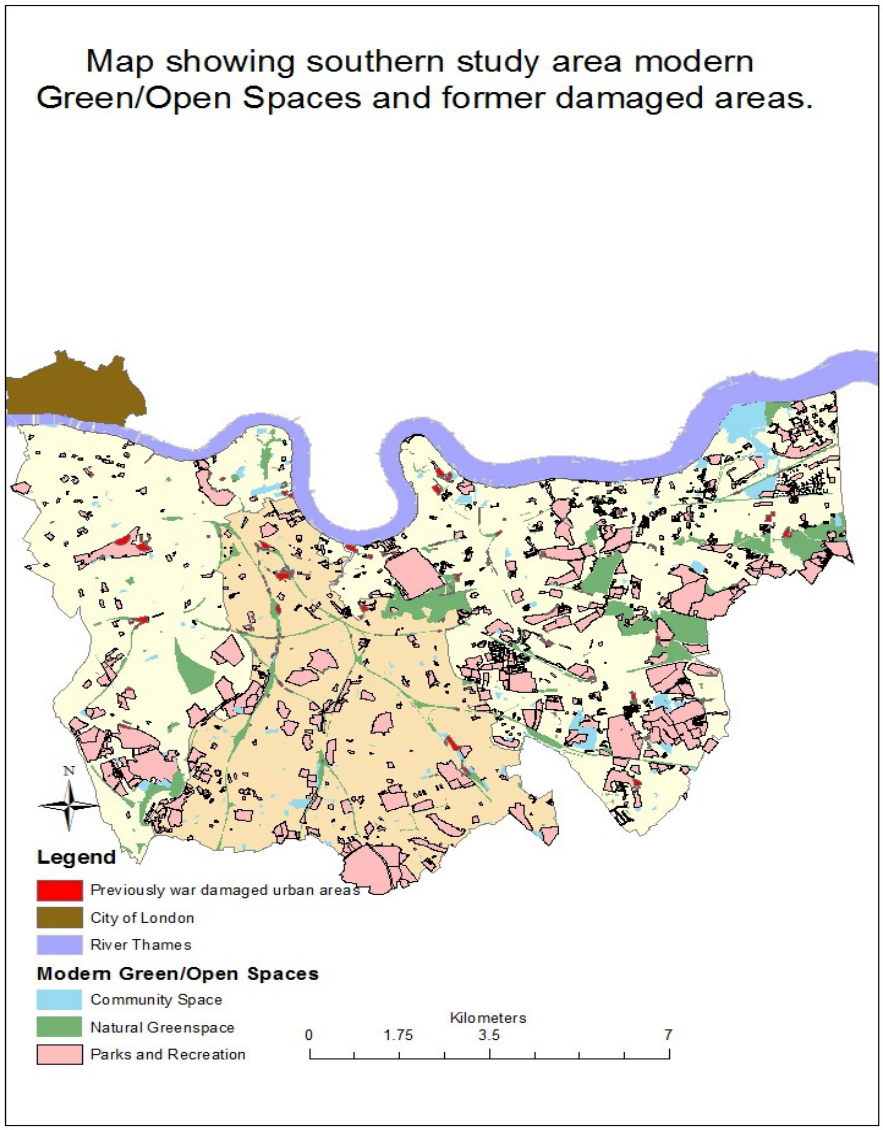
New Borough	Designation	Former Boroughs		
Camden	Inner	Hampstead	St Pancras	Holbom
Greenwich	Inner	Greenwich	Woolwich	
Hackney	Inner	Hackney	Shoreditch	Stoke Newington
Hammersmith	Inner	Hammersmith	Fulham	
Islington	Inner	Islington	Finsbury	
Kensington and Chelsea	Inner	Kensington	Chelsea	
Lambeth	Inner	Lambeth	Wandsworth *	
Lewisham	Inner	Lewisham	Deptford	
Southwark	Inner	Bermondsey	Camberwell	Southwark
Tower Hamlets	Inner	Bethnal Green	Poplar	Stepney
Wandsworth *	Inner	Battersea	Wandsworth *	
Westminster	Inner	Paddington	St Marylebone	Westminster

It is important to note that the current Borough designations newer than the ones used in the 1930's before the war. Prior to 1963, there were many more boroughs (29 inner city Boroughs) but these were consolidated into 13 Boroughs and the City of London on the basis of the 1957 Royal Commission into governancy in London by the London Government Act 1963. Many of the old Borough names are still present in London as wards designations, but chart 2 below explains the old and new consolidated regions and accompanying map shows the study/target areas chosen in relation to the Greater London.



Map 1: Map of Greater London Area and Boroughs

3.4.2. Southwark, Lewisham and Greenwich



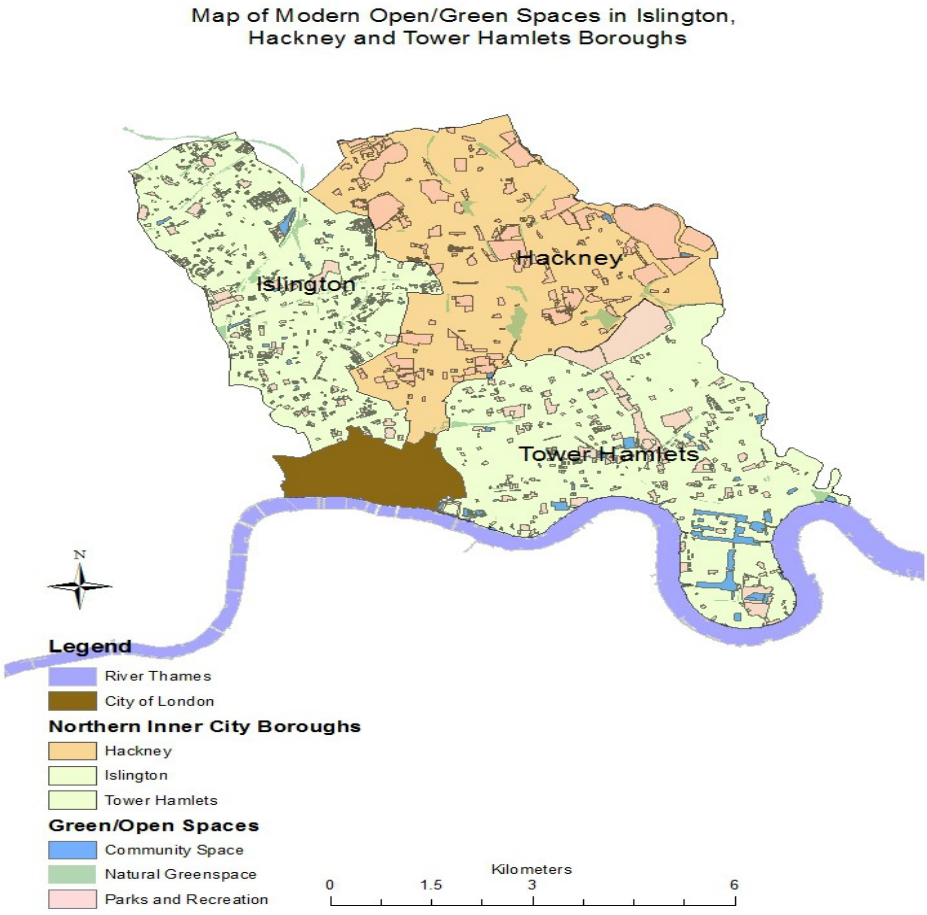
Map 2: Map of Modern Open/Green Spaces in Southwark, Lewisham and Greenwich

Southwark, Lewisham and Greenwich encompass the three boroughs south of the Thames in the study area. Lewisham and Southwark, being the closest two to the city of London are characteristically more urban than Greenwich, which is a transition zone betwen the urban and suburban and even rural fringes. All three have clusters of kept parks surrounding the central shipping and residential areas of the districts, which themselves surround rail access from the central London stations. Of particular interest is Greenwich, which of the 6 areas studied has the most actual natural land and indigenous forest. The eastern areas of Greenwich was a traditional royal hunting ground in times past (It is still called The Royal Borough of Greenwich) and kept pristine and almost in a natural state. In later centuries,

this area was given over to the Royal Observatory, which is the site of the prime meridian of the mercator system and now a world heritage site.

4.4.3 Tower Hamlets, Islington and Hackney

In contrast to the relatively green areas south of the Thames, Tower Hamlets, Islington and Hackney are decidedly urban and inner city in nature. There is no urban/suburban fringe present and very little semi natural greenspace with zero natural or indigenous space surviving the urban growth of London. As these Boroughs are directly adjacent to the

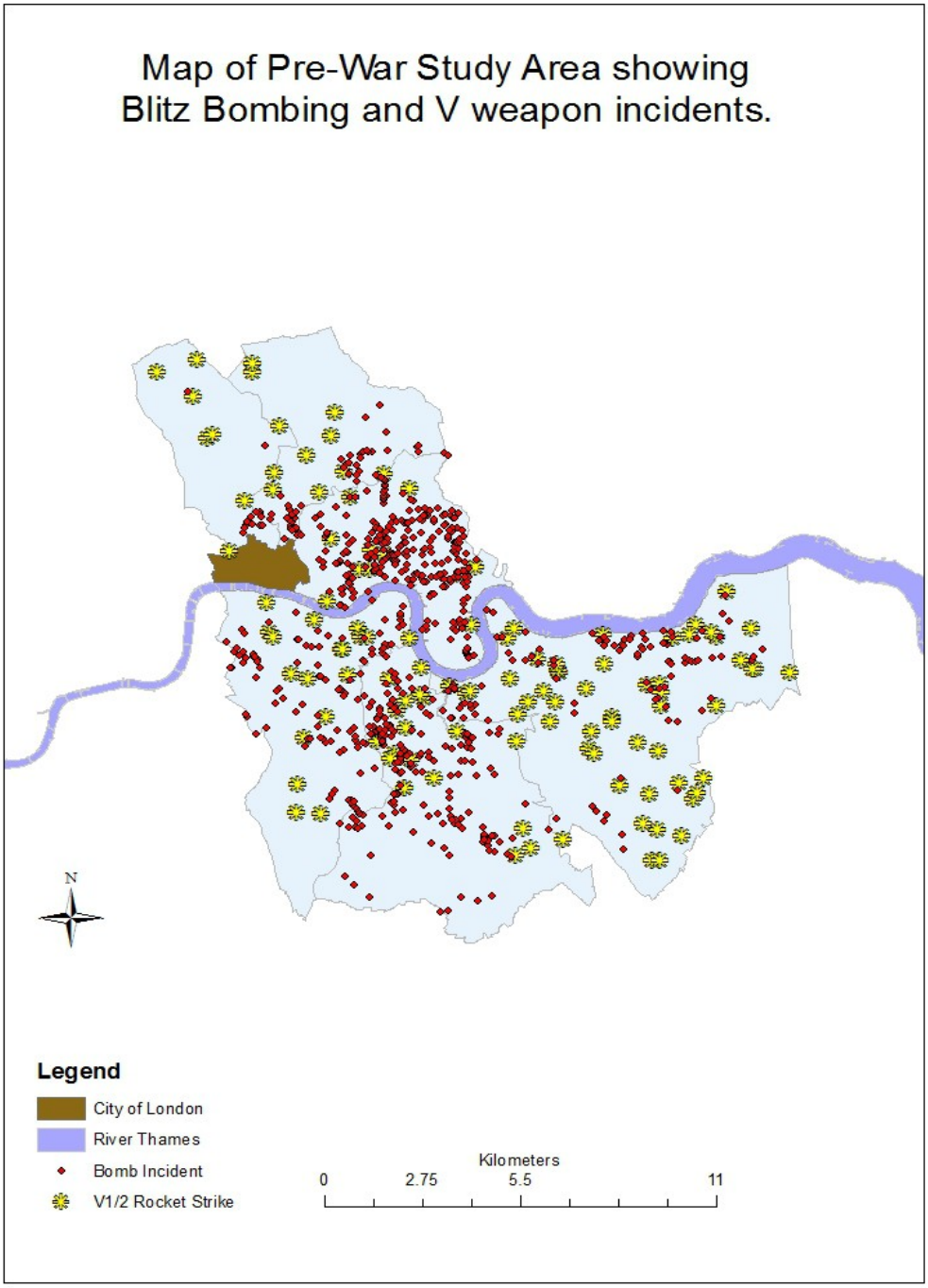


Map 3: Map of Modern Open/Green Spaces in Islington, Hackney and Tower Hamlets Boroughs

central City of London they are increasly inner city in nature closer to their central point alonside the Thames. Also of interest is the former industrial dockland of the Isle of Dogs at the very base end of the Tower Hamlets borough. This dockland, now repurposed for other uses as heavier modern shipping needs have made the shallow docks obsolete, was heavily targetted by bombings during the war for its strategic value. alonside the Thames.

4. Chapter 2: Damage in the Study Area

The damage in London from the Blitz bombings and V weapon strikes is very comprehensive and widespread. Individual incidents of bomb drops number in this

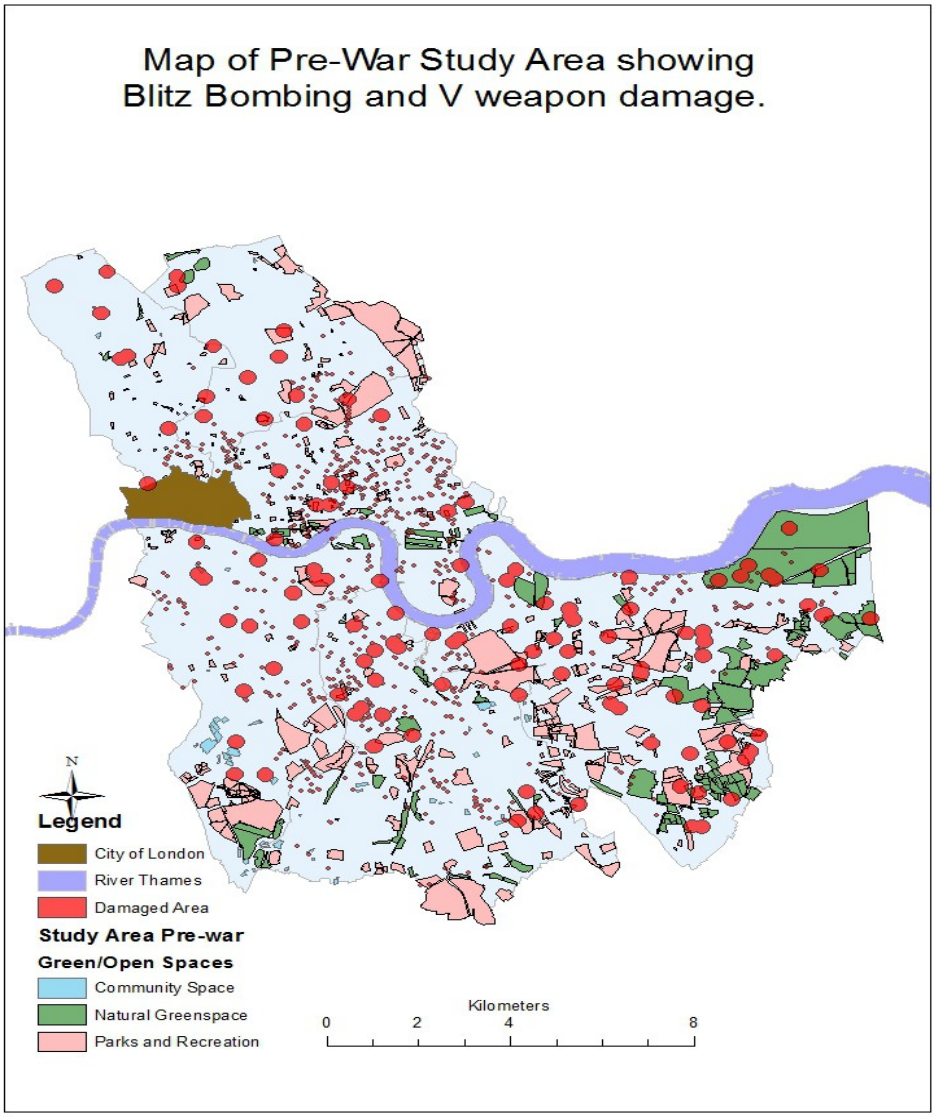


Map 4: Map of Pre-war Study Area Showing Blitz Bombing and V weapon Incidents

thousands, and those are only the recorded drops where government agents could collect data immediately after the incident. The following map shows an small section of these incidents , an aggregate based on a single weeks bombings but also including the sum of known V1/2 strike locations. The majority of the incidents have happened towards the centre of the study are, being the most heavily populated and central areas of the region.

The rocket strikes are more spread out but do decrease in frequency further away from the urban centres of the region. Interestingly, there are a number of rocket strike locations in the central area of Greenwich, which was comprised of commons, golf courses and other open spaces and relatively lightly populated. This is evidence of the effort counter espionage attempts at misleading spy networks about the accuracy of the strikes in order to differ damage, the Nazis were never able to confirm directly themselves that their rockets had actually hit the targets.

Overlaying a buffer of 50m and 180m to the bomb and rocket strikes respectively creates an excellent view of the potential damage from this set of incident data. Again the damage is comprehensive, across the entire study area 19.80% of the total area has been damaged



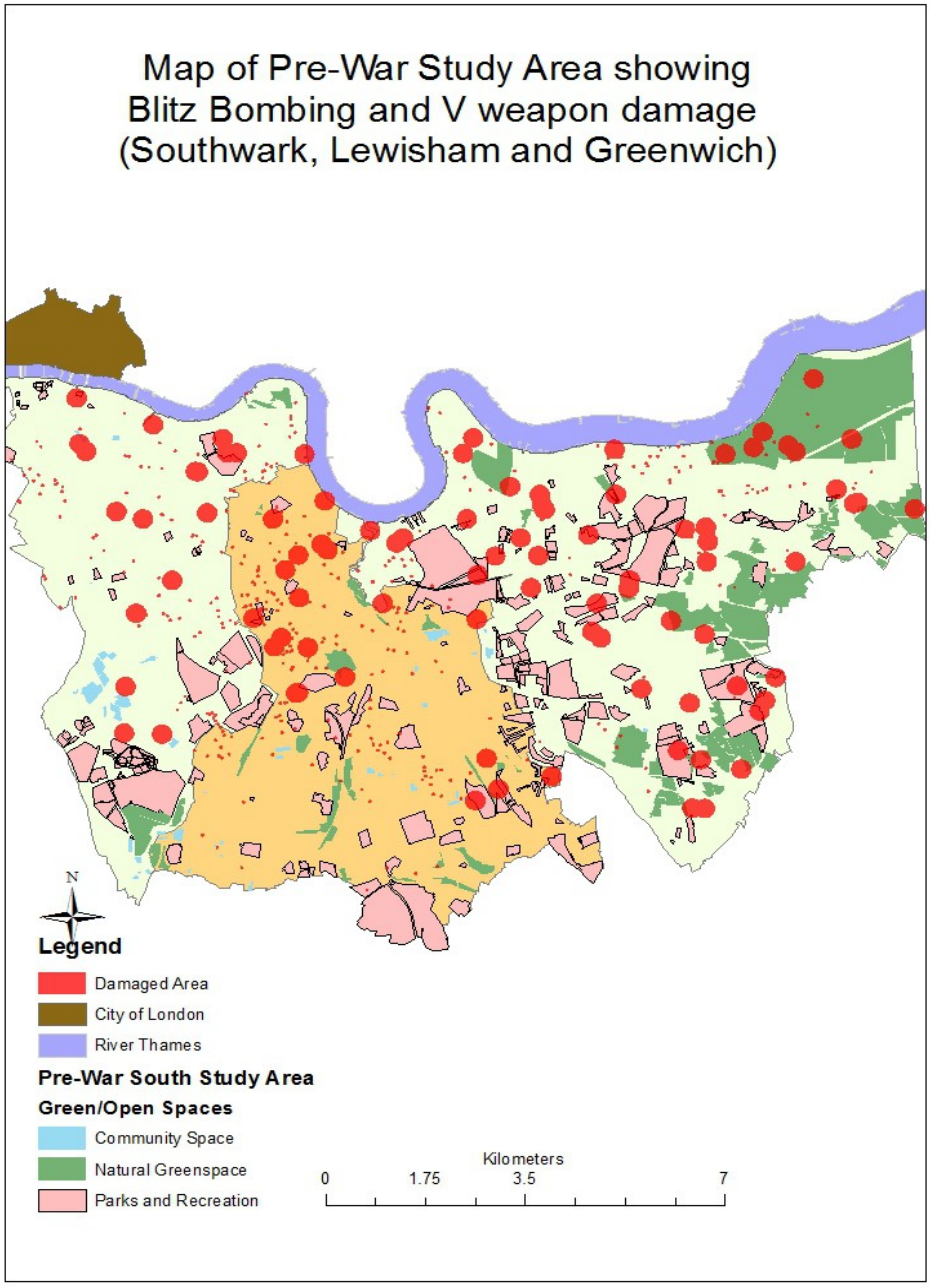
Map 5: Map of Pre-War Study Area showing Blitz Bombing and V weapon damage

or destroyed by these incidents. It must be noted that this is the potential damage and not an accurate reflection of the actual damage, which would be impossible to calculate

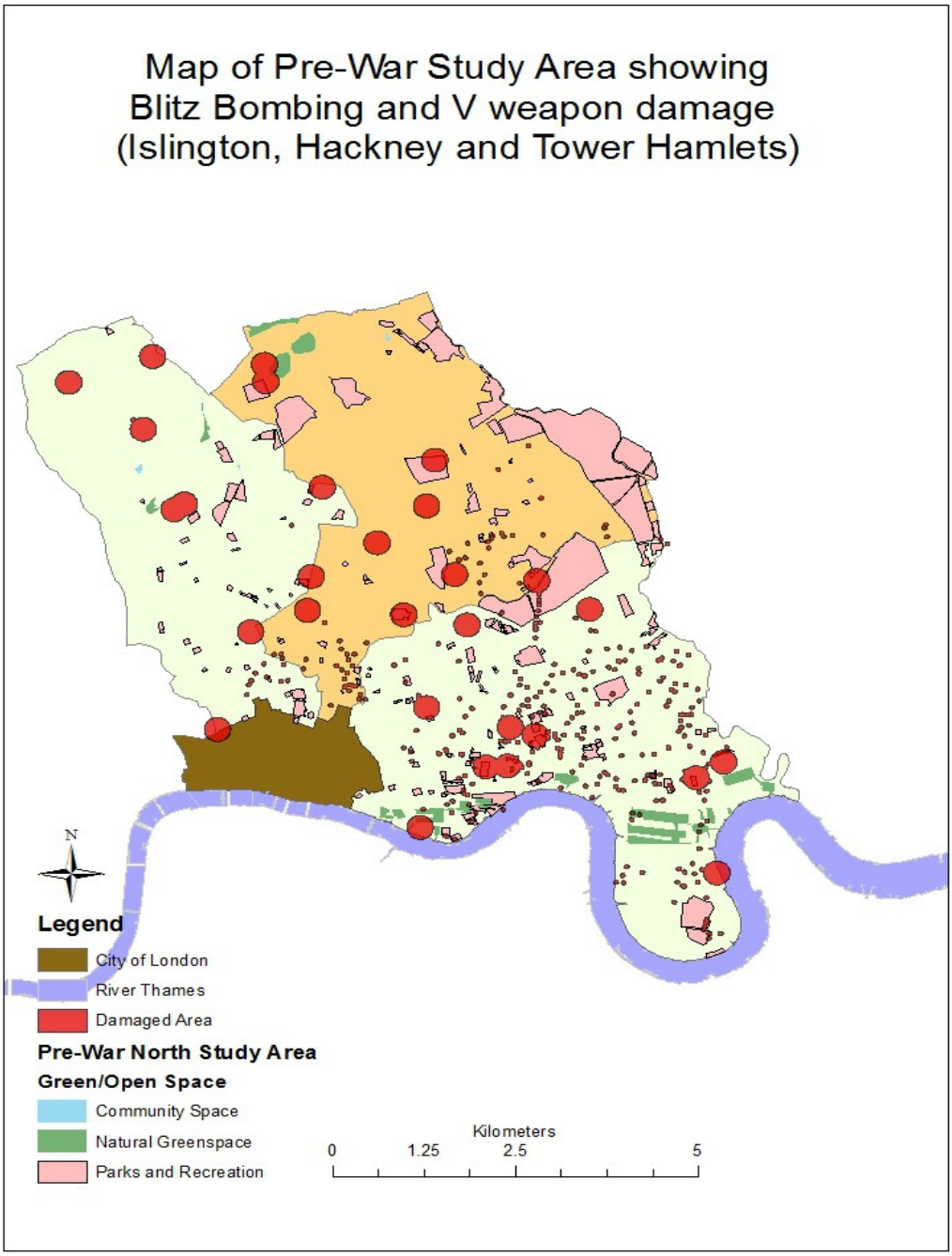
without contemporary aerial photography, however the damage area errs on the smaller side of estimation as the bomb and rocket incidents themselves are only the point location of the impact and do not account for the spread of fire and chain explosions that might have happened. Nonetheless this is a good approximation of the damage.

With regards to the damage itself, it is evident that the larger nature of the V1/2 ordnance and explosion radius means that the rockets have “touched” more area on the ground than the bombs have achieved, which focused on smaller scale explosions at a mass level of execution. However it must also be taken into consideration that many of the areas overlap and the bombing incidents happened 3 years before the rockets began to strike. In these cases, although the damage is more effective from the rockets, it would be merely destroying the rubble from previous attacks. However, due to the inability to warn against V2 strikes in any way, the loss of life from these strikes bound to be higher.

Across the boroughs of the study area the damage seems to be uniform, but Greenwich, which had the highest proportion of existing open and green spaces has taken the brunt of the rocket strikes due to its position as the eastern most inner city area that would be a viable target. Of the bombing incidents, Hackney has taken the most hits.



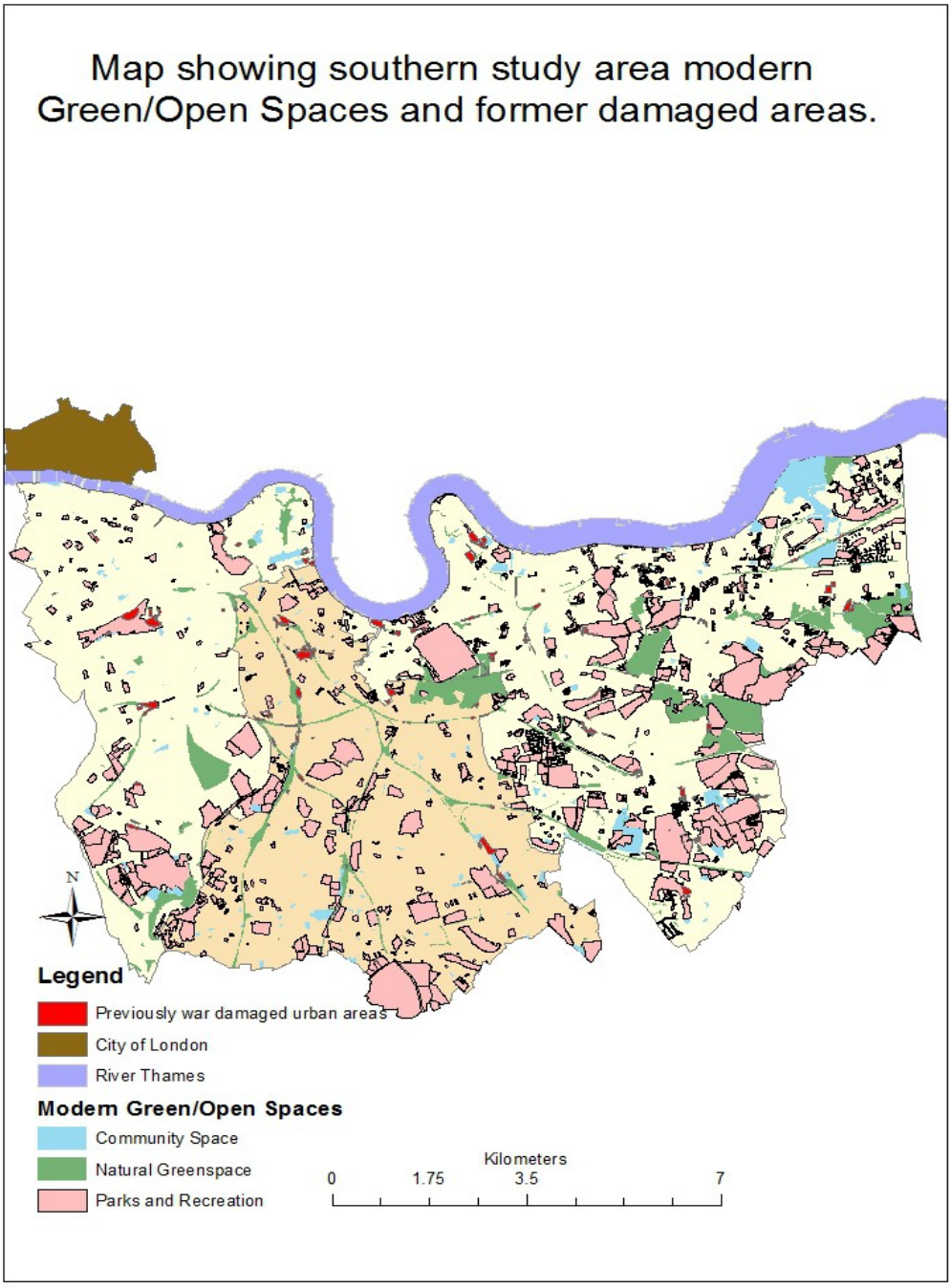
Map 6: Map of Pre-War Study Area Showing Blitz Bombing and V weapon damage (Southwark, Lewisham and Greenwich)



Map 7: Map of Pre-War Study Area showing Blitz Bombing and V weapon damage (Islington, Hackney and Tower Hamlets)

5. Chapter 3: Comparative GIS

With the extent of the potential damage known from the previous chapter, it is now possible to examine how the damaged areas have been used in the reconstruction process. This has been done by selecting all the urban areas from the 1930's maps which have been damaged from the bombs or rocket incidents and seeing which of these areas are now green or open spaces that did not exist before. What is evident is that the overall level of green and open space has increased by only a small percentage of this (around 10.57% on average around the study area) has been utilised to create new green spaces. Furthermore, it

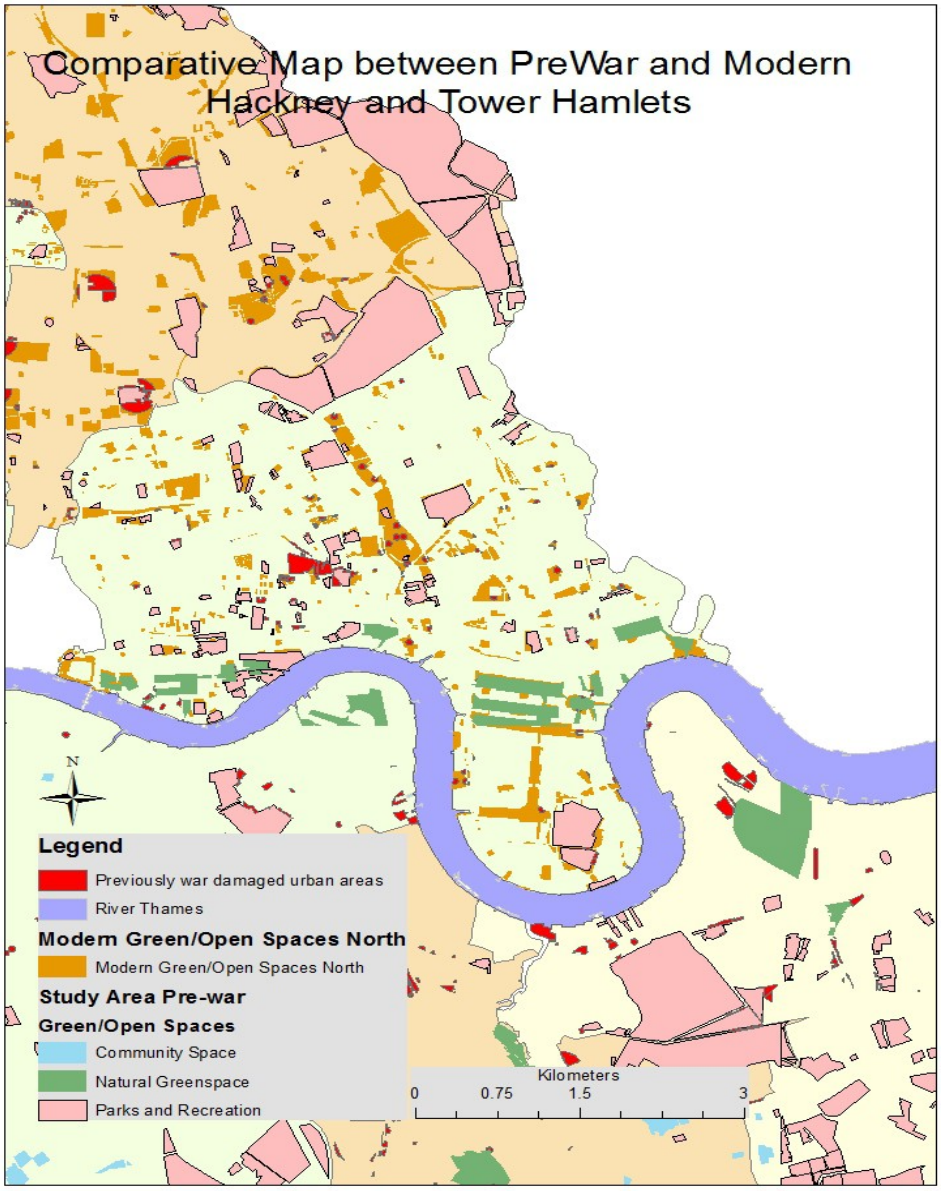


Map 8: Map showing southern study area modern Green/Open Spaces and former damaged areas

appears that the “new” greenspace in most cases has been used to expand adjacent existing greenspaces, i.e. an existing park extended to encompass more area from a destroyed row of houses as opposed to reassigning areas altogether.

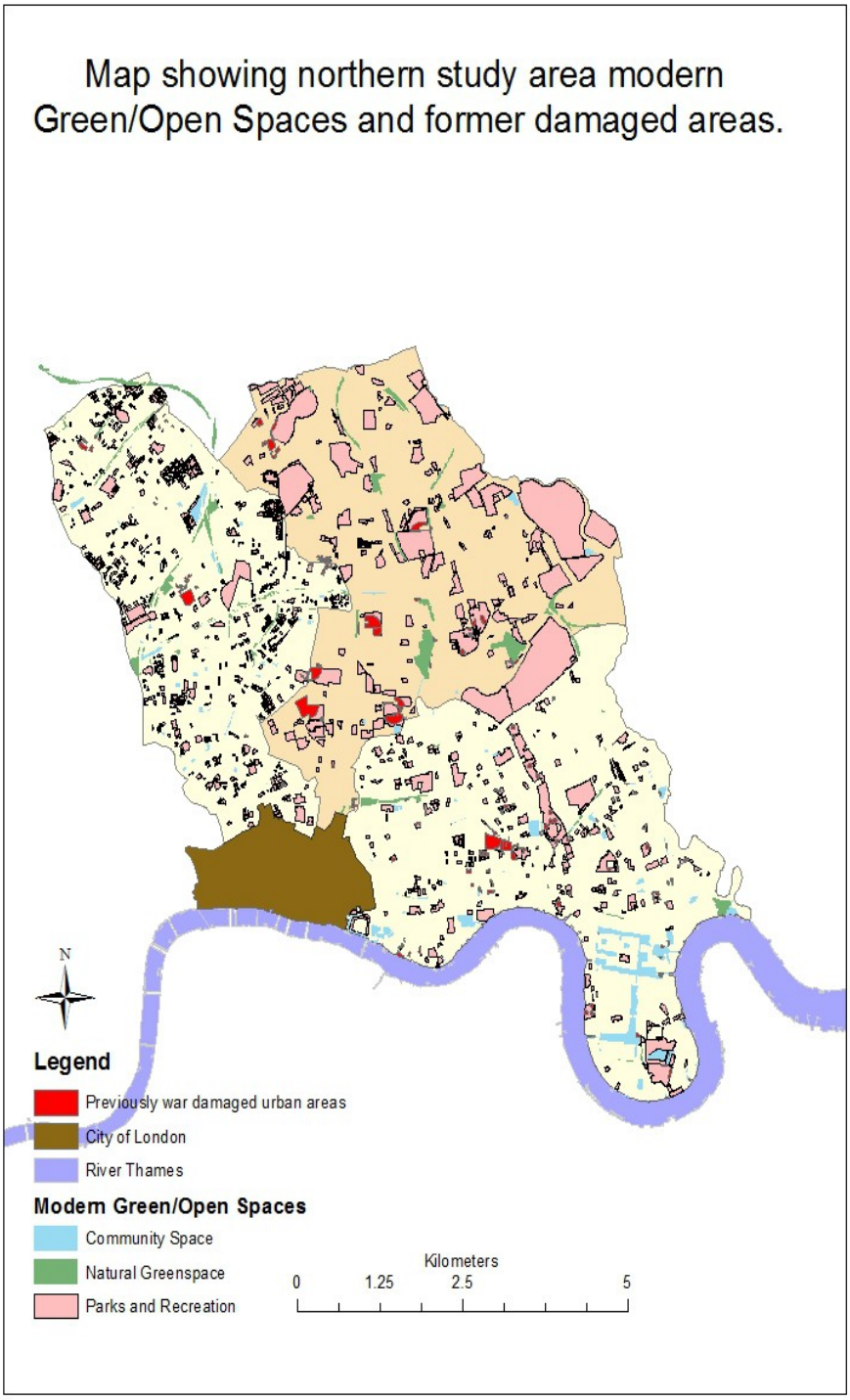
The below maps shows a good example of one of the more inner city parts of the study area Hackney and Tower Hamlets. The overall area of green and open space has increased drastically but only a small percentage of the damaged area has been utilised for green space, (Hackney 14.74% and Tower Hamlets 13.77%). Furthermore these changes are not drastic in nature but opportunistic, existing green spaces were kept and expanded on where

Map 10: Comparative Map between Pre War and Modern Hackney and Tower



Hamlets

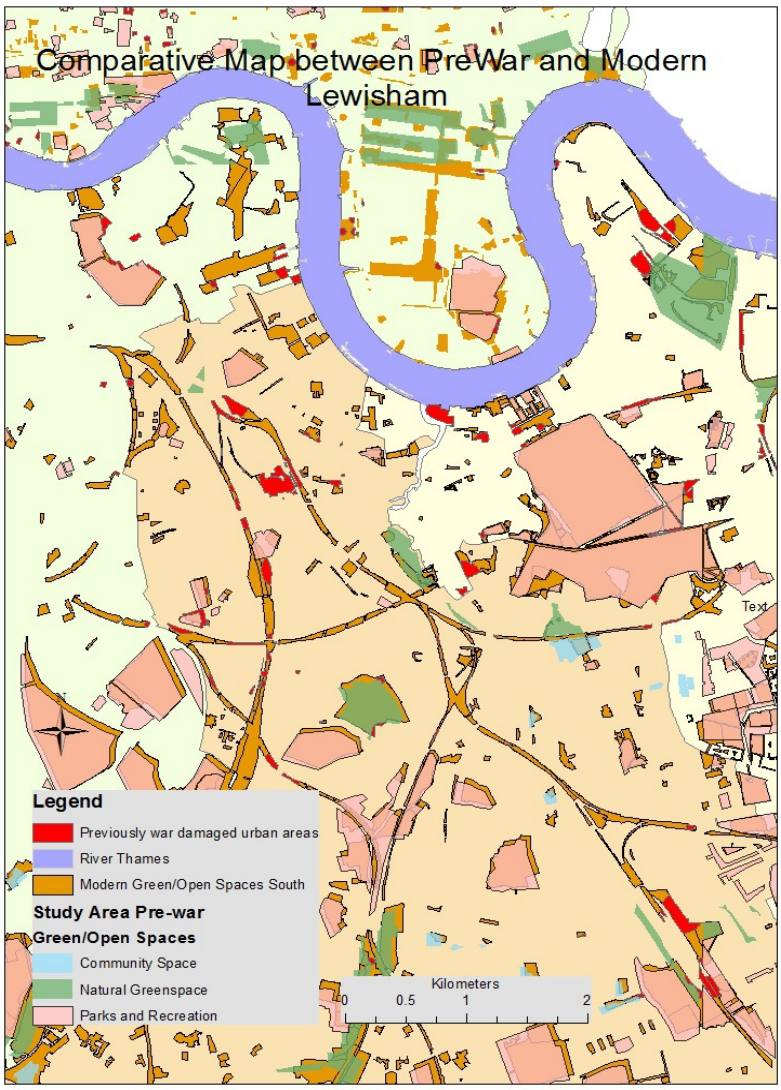
the amount of truly new green/open spaces is very low. The large area in the middle of the map above is one of the biggest examples of new green space created in damaged area called Stepney Green which was formalised as a green common in the 1960's.



Map 9: Map showing northern study are modern Green/Open Spaces and former damaged areas

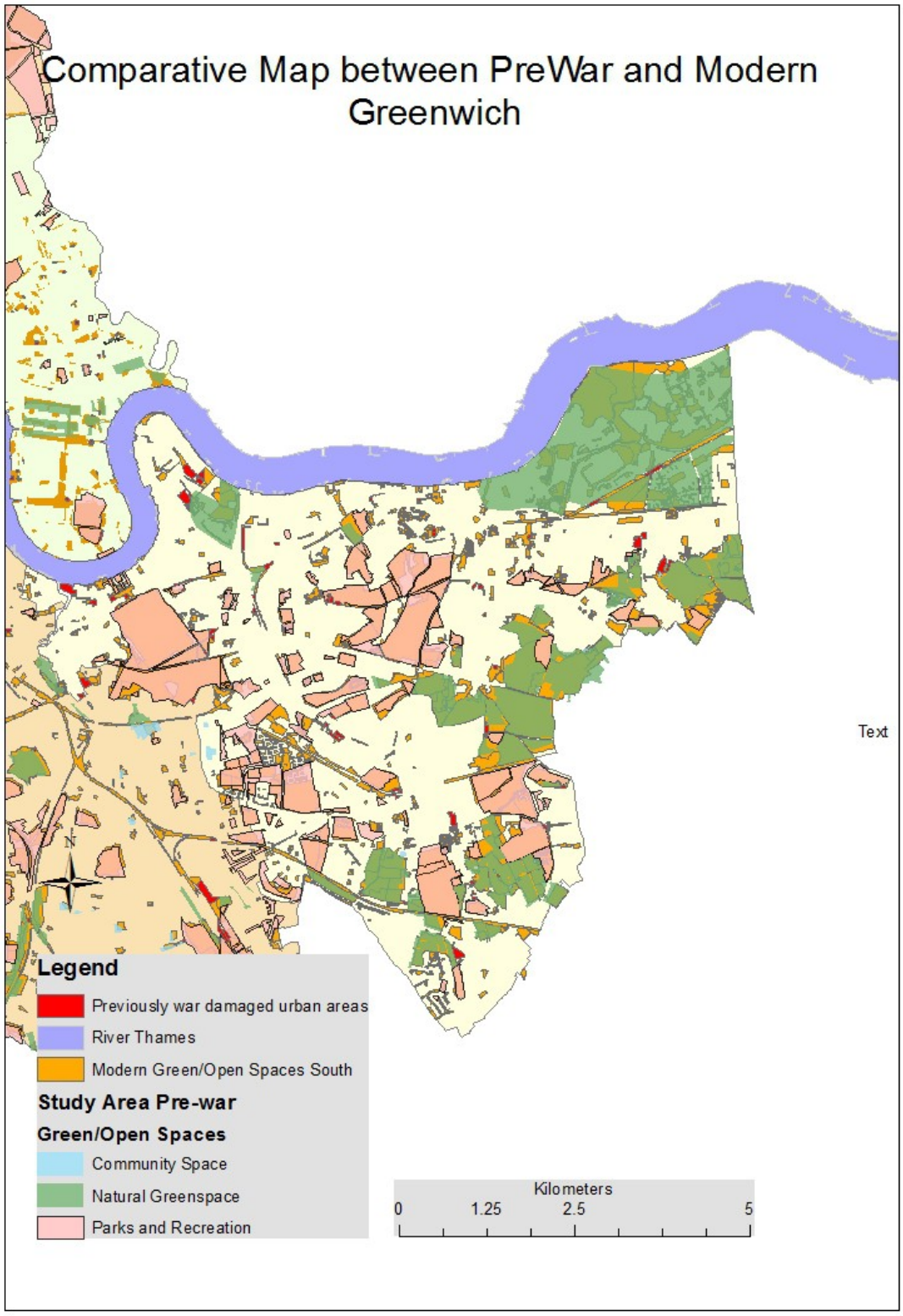
South of the Thames there same pattern emerges in all areas barring Greenwich. Existing

green and open spaces have been kept, however Lewisham and Southwark have had an increase of natural or semi natural greenspaces (mostly green corridors from the map). One example of complete utilisation of damaged area is from the middle of Lewisham where one finds Fordham Park. This greenspace has an uncanny outline matching the exact damage of the area where a V2 rocket has struck, and does not exist on previous maps. This is a clear example that planners have decided to utilise damaged areas for greenspace in some situations, but the tendency still seems to opportunistic rather than a structured approach to the rebuild effort.



Map 11: Comparative Map between Pre War and Modern Lewisham

Greenwich however forms an interesting exception to the trend of creating more greenspace, regardless of source, in that it has lost some 9.57% (see chart 4) of its Pre War existing green-spaces to urban growth. There is no single area in which there is vast



Map 12: Comparative Map between Pre War and Modern Greenwich

evidence of this change, but rather again opportunistic changes made in small areas, very

little of this has to do with war time damage and can be attributed to post War urban growth. One area which has changed the most is the urban farm land on the far right of Greenwich. This area remains farmland but has lost some of its area to urban buildings. Likewise, the categorisation of the individual land parcels is much more accurate from the information provided by the modern GIS driven metadata, allowing for a far more accurate categorisation. This is one of the major short comings of using older maps which are limited to visual and colour based representation of metadata only. This is further discussed in the following conclusions chapter.

In all areas, there is very little or no evidence of a change towards a more Garden City ideal urban situation other than the general approach to supplement urban growth with allocation of green or open spaces.

Pre War Area (Ha)	Total Area	Urban Area	Green/open space total	Green/Open Percentage	Parks and Recreation Area	Community Space Area	Natural Greenspace Area	Damaged Area	% Damage Area of total
Hackney	1904.90	1574.69	330.21	17.33%	307.57	0.41	22.23	299.12	15.70%
Islington	1485.66	1437.16	48.50	3.26%	42.57	1.17	4.77	208.01	14.00%
Lewisham	3531.71	2927.24	604.47	17.12%	469.84	23.28	111.34	573.36	16.23%
Southwark	2991.34	2548.14	443.20	14.82%	346.90	39.22	57.07	500.73	16.74%
Greenwich	2157.50	257.53	1899.97	88.06%	704.73	4.45	1190.78	1343.32	62.26%
Tower Hamlets	5044.19	4768.17	276.02	5.47%	207.90	1.00	67.12	464.29	9.20%
Total	17115.30	13512.95	3602.36	24.34%	2079.52	69.52	1453.31	3388.82	19.80%

2015/5 Area (Ha)	Total Area	Urban Area	Green/open space total	Green/Open Percentage	Parks and Recreation Area	Community Space Area	Natural Greenspace Area	Previously Damage Urban Space	% Previous Damage Urban Space
Hackney	1904.90	1441.012	463.89	24.35%	411.69	5.76	46.44	68.38	14.74%
Islington	1485.66	1288.724	196.94	13.26%	153.13	16.12	27.69	19.70	10.00%
Lewisham	3531.71	2763.186	768.52	21.76%	579.26	49.55	139.71	70.15	9.13%
Southwark	2991.34	2420.09	571.25	19.10%	394.75	44.56	131.94	54.26	9.50%
Greenwich	2157.50	439.331	1718.17	79.64%	1165.38	180.25	372.54	107.50	6.26%
Tower Hamlets	5044.19	4684.04	360.15	7.14%	271.32	74.31	14.52	49.60	13.77%
Total	17115.303	13036.383	4078.92	23.83%	2975.53	370.55	732.84	369.59	10.57%

% Increase	Urban Area	Green/open % inc	PnR % Inc	Community Space Area	Natural Greenspace Area
Hackney	-8.49%	40.48%	33.85%	1312.83%	108.93%
Islington	-10.33%	306.05%	259.74%	1279.12%	481.02%
Lewisham	-5.60%	27.14%	23.29%	112.88%	25.48%
Southwark	-5.03%	28.89%	13.79%	13.62%	131.17%
Greenwich	70.59%	-9.57%	65.36%	3947.67%	-68.71%
Tower Hamlets	-1.79%	30.48%	30.50%	7331.00%	-78.37%

Chart 4: Statistical Findings of the Comparative GIS

6. Conclusions

The damage of the Blitz and V1 and V2 rocket strikes was utterly devastating, no only in terms of life lost (despite defence efforts) but also in the amount of damage London and its surroundings sustained. In the study area alone, half of the inner city boroughs, a total of 3388 Hectares of land was damaged or destroyed by these incidents. Across the various parts of the study area, using an small section of the captured bomb incidents, this meant almost or complete destruction in a massive 22.36% of the total area in one of the biggest cities in the world, even during the late 1930's and early 1940's (see Chart 4).

Part of the response to this bombing was the promise of a better London for all after the war in accordance with Howard's Garden Theory and other works promoting the creation and utilization of green and open spaces for improved health and quality of life, a move away from the factories and urban sprawl that had characterised London for more than 100 years at this point. What is evident from the maps I have created is that this ideal was not really followed at all. The idea of creating several smaller garden cities, themselves easily the size of a borough or perhaps smaller (one of the bigger boroughs like Greenwich could have easily held two garden cities) was not adhered to at all. There are is no post war centralisation of urban centres and ringing these with suburban and natural green belts. However to state this broadly is to not take into account that there has been come conscious effort on the part of planners to increase the amount of green and open spaces for Londoners. Across all boroughs, post war greenspace has increased, most notably in Islington which had a 306% increase in areas designated as green or open space. Greenwich, the exception to this rule with a 9.5% decrease in green spaces still has an incredible amount of green space (79.64% of total 2157 Ha in 2015). Overall utilisation of previously damaged urban areas that became greenspace is 10.57%, which is not insignificant in number. While the war time promises of a greener better London for all might not have come to fruition on a macro scale, there has been a definitive effort to move in this direction, and other post war sources of green space allocation account for a significant change.

As such, it is my suggestion that this method of comparative GIS is a sound means of comparing pre and post destruction land utilisation and changes. This method would be particularly useful and extremely accurate in a situation where modern GIS data would be available. From working with maps created during the 1930 to 1960 period, it is very evident that there is a not insignificant level of data loss. Firstly the maps were created by hand and without the aid of computer calculation. That the maps were able to mesh with

modern maps on some level is a testament to the art and skill of the previous generations cartographers and geographers. However, even with spending several hours on finding the correct georeferenced transformations between the old and new maps, there is still some level of inaccuracy that can be easily seen.

Furthermore to this, the nature of the way “metadata” was stored in the old maps leads to vast differences. In the pre War maps, metadata was stored visually, by marking areas with trees and other symbols to indicate that they were green or open space. These symbols were ambiguous at times and one often had to guess what the properties of an individual field boundary or land parcel might be. This estimation is in no means perfect and it is impossible to calculate how much area has been incorrectly assigned due to this. Likewise, the maps were printed with a maximum of 4 colours in addition to the colour of the paper it was printed on (usually representing open land). Orange, blue, green and brown plus the beige of the map paper formed the mere 4 categories of land use that could be classified without specifically writing the name of the place on the map itself, a thing reserved for larger or more important features only. By contrast, the modern computer generated data I was provided for the open spaces of London held exponentially more data than the simple maps from the 1930's. Each different land parcel that fell into the category of open or green space was given 27 levels of data with which to make the categorisation, which in of itself was extremely easy since they have used the same categorisations provided by the Greenspace Information for Greater London.

This is most evident in the maps I have created by the allocation of community space. The majority of these areas are extremely small, such as small city gardens only a couple of square meters in area. These must have existed on a small scale prior to the bombings and creation of the ordnance maps but are impossible to label correctly with the means of the day. Additionally, there might not have been the same emphasis on the allocation of these areas on the ordnance map and they may have been swept up in larger private land parcels. Likewise, due to the classification error mentioned above, many of these parcels might have been classified as something other than community space. When compared with the modern GIS metadata driven maps, the community space allocation has shot up in numbers incomparable to the trend in other categories, most notably in Tower Hamlets and Greenwich which saw a 3900% and 7500% increase in community space respectively. It is entirely possible that these are an accurate reflection of the change, the large urban farm land in the far east of Greenwich was changed from semi-natural open space to community farms, accounting for a large increase in hectares in this category. However I would

attribute such large discrepancies to the nature of working with older maps rather than an actual change on the part of urban planners at the time. This does however work to show as a good practical example of the limitations and methods of integrating hand and computer drawn maps.

Chart 4: Statistical Findings of Comparative GIS

8. List of Charts, Images and Maps

List of Charts:

List of Images

List of Maps:

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